ATTENUATION OF NOISE FROM STEAM INJECTION IN POULTRY SCALD TANKS

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CONTENTS

ILLUSTRATIONS

TABLES

ATTENUATION OF NOISE FROM STEAM INJECTION IN POULTRY SCALD TANKS

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ABSTRACT

Three steam-injector designs were tested against the drilled-pipe device used in the scald tank of a commercial poultry-processing plant. An arrangement of suction tees reduced steam-injection noise 16 dBA (descibels, A weighted scale), from 101 to 85 dBA, while decreasing water-heating time from 40 to 32 minutes. **KEYWORDS: noise attenuation, poultry scald tanks, poultry-processing equipment, steam-injection heating.**

INTRODUCTION

A major problem in poultry-processing plants is the excessive noise generated by equipment. Processors must reduce noise to meet the standards of the Occupational Safety and Health Act (OSHA) of 1970. This is a difficult task because noise does not originate from any single operation or machine; it extends throughout the plant and is considered localized only because of high sound-pressure levels in certain areas. Of particular concern is the scald-pick area. Appreciable reduction of noise in this area will help reduce noise levels throughout a plant.

Measurements of sound-pressure levels were made in the scald-pick area of a commercial poultry-processing plant to locate noise sources and the contribution of each source to the general din. The main contributors were the scald tanks, 97 dBA (decibels, A weighted scale); pickers, 103 dBA; and conveyor lines, 102 dBA. The total noise level was 105 dBA. Although the greatest overall noise reduction would be accomplished by reducing noise from the pickers and conveyors (all three mechanisms need to be quieted to conform to OSHA standards), pickers and conveyors are comprised of numerous mechanical components (bearings, motors, chain drives, gear drives, cowling, etc.) requiring separate, sophisticated, and expensive maintenance to reduce noise. Scalders, however, have only two noisy components: pumps and steam-injection devices. For this reason, it was decided that the most significant immediate reduction in total noise could be achieved by reducing the noise from the steam-injection devices used for heating the water in scalders. Three devices were tested against the drilled-pipe sections used in the commercial plant (fig. 1).

TESTS AND RESULTS

The scalder in the poultry-processing plant was a four-pass, multisection tank approximately 35 feet long. Noise generated by the scalder was broken down into two components: pump and waterflow, and steam injection through drilled-pipe sections. Pump and waterflow contributed 90 dBA; steam injection, after the water reached the scald temperature (128° F), contributed 97 dBA at 80 lb/in^2 of steam pressure. It had been thought that maximum steam-injection noise would occur during the

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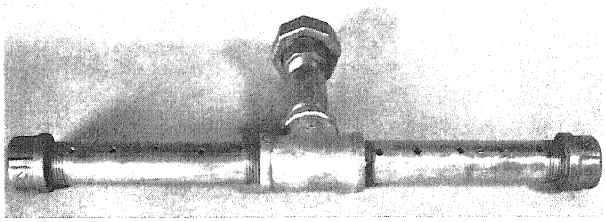


FIGURE 1.—Drilled-pipe steam injector. This type of device is commonly used with commercial scald tanks.

initial release of steam in the cold water. Such was not the case: steam impact produced 96 dBA, and sound-pressure level then decreased to 94 dBA, gradually increasing to the final level of 97 dBA.

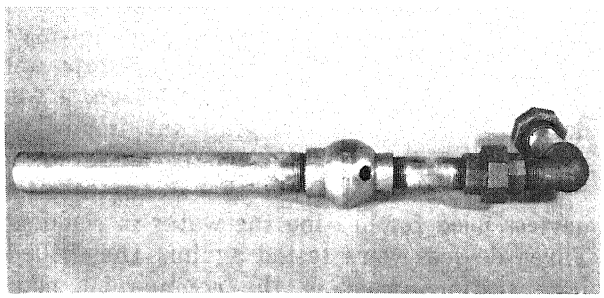
The scalder used in pilot-plant studies of alternative steam-injection devices was similar but was a single-pass, single-section tank approximately 5 feet long. The tank held approximately 155 gallons of water and was equipped so that various steam-injection devices could be interchanged for tests. During the entire water-heating cycle the devices were monitored to determine normal heating time and sound-pressure levels at selected intervals.

The first device tested was a 2¼-inch hollow sphere connected to the steam line and followed by a 7-inch length of 1-inch pipe acting as a reentry tube (fig. 2). The device was immersed in the water in the scald tank. Steam at 60 lb/in² continuously entered the sphere through the pipe connected to the steam line. Steam velocity increase, through a nozzle terminating just short of the reentry tube, drew scald-tank water into the sphere through four holes by jet action. The steam and water mixture was then discharged through the reentry pipe into the water in the scald tank. The steam heated the water as it continuously circulated through the device.

An initial test was run with the spherical injector to determine normal heating time and set a standard for steam pressure to be used. The other steam-injection devices were sized to produce comparable steam pressure and heating time.

The second device tested was a ¾-inch siphon pump (fig. 3). Since this device is intended for pumping fluid with minimum steam, steam flow is severely restricted. The operation of the siphon pump is similar to that of the hollow sphere. It was necessary to use two siphons to heat the water sufficiently, but even with two pumps, the heating period was longer than that for the hollow sphere.

A suction tee was the third device tested



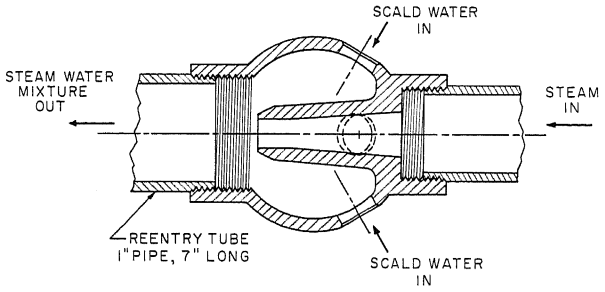
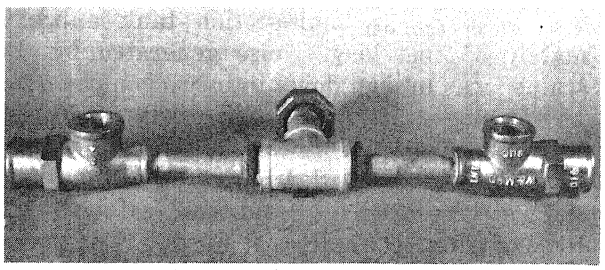


FIGURE 2.—Hollow-sphere steam injector. This type of device was originally installed in a single-pass, 5-foot scald tank used for pilot-plant tests. Jet nozzle is an integral part of device, but a short pipe section must be attached on the downstream side to act as a reentry tube.



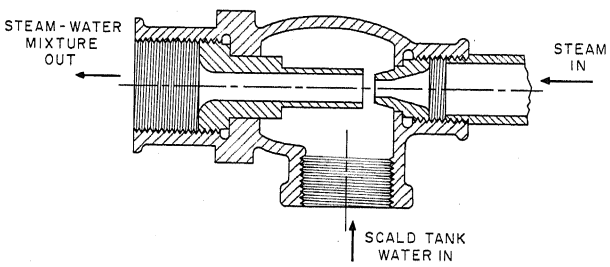


FIGURE 3.—Siphon-pump steam injector. Jet nozzle and reentry tube are integral parts of the device.

TABLE 1.—*Test conditions and comparative performance of four steam-injection devices*

[Steam pressure, 60 lb/in²g; initial water temperature, 64° F]

Measurement	Steam-injection device			
	Hollow sphere	Drilled pipe	2 Siphon pumps[1]	Suction tee
Background noise during tests ..... dBA	60	58	59	57
Steam-impact noise ..... dBA	80	79	83	82
Noise during heating:				
At start ..... dBA	74	80	70	71
After 5 minutes ..... dBA	77	81	70	69
At 116° F water temp. ..... dBA	77	81	71	70
At 128° F water temp. ..... dBA	78	82	70	71
Elapsed test time ..... min	50	55	64	50

[1] Initial water temperature, 65° F.

(fig. 4). Its design and operation is very similar to that of the hollow sphere.

All devices were monitored during the entire water-heating cycle to detect any unusual variations in sound-pressure level. Sound-pressure levels are reported only for five specific times or temperatures during the heating cycle, but where a pressure-level change occurred during the interval between reported times, the change was uniform (table 1).

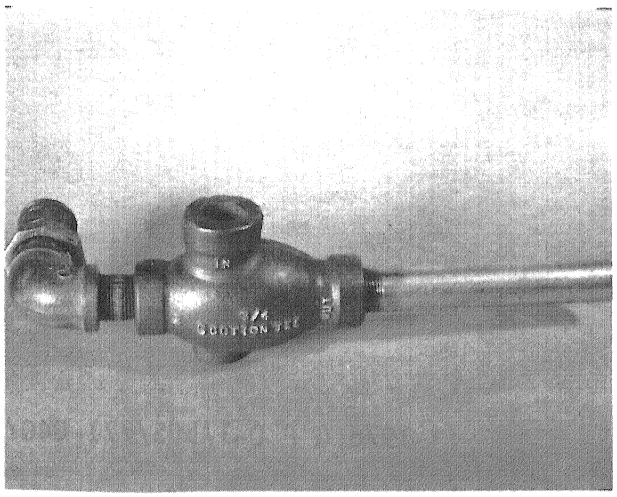
The double siphon pump and the suction tee produced the least noise. Of the two, the double siphon pump produced 1 dBA less noise, but it required 28% more time to heat the tank water to 128° F and cost $49.50, as compared to $6 for the suction tee.

Prior to equipping the 35-foot, four-pass com-

TABLE 2.—*Comparative noise levels for two steam-injection devices used in a commercial poultry scalder*

[Steam pressure, 100 lb/in²g]

Measurement	Steam-injection device	
	Drilled pipe	Suction tees
Background noise during tests ..... dBA ...	76	77
Steam-impact noise ..... dBA ...	96	83
Noise during heating:		
At start ..... dBA ...	95	83
After 5 minutes ..... dBA ...	96	84
At 116° F water temp. . dBA ...	101	85
At 128° F water temp. . dBA ...	101	85
Elapsed test time ..... min ...	40	32



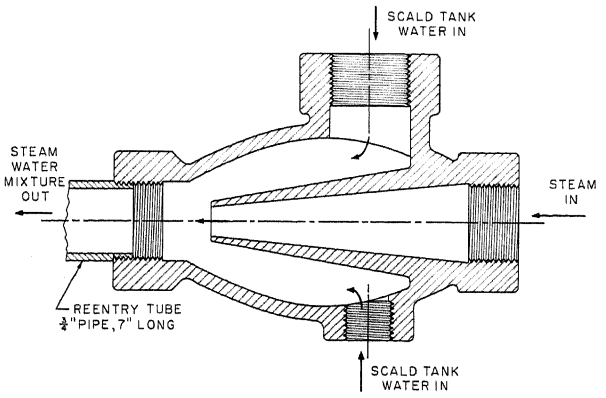


FIGURE 4.—Suction-tee steam injector. Jet nozzle is an integral part of device, but a short pipe section must be attached on the downstream side to act as a reentry tube.

mercial scalder with suction tees, the steam-injection sound-pressure level was 101 dBA (steam pressure had been increased from 80 to 100 lb/in^2). Replacing the original drilled-pipe injection devices with 28 suction tees reduced steam injection noise 16 dBA, from 101 to 85 dBA (table 2). The cost was $168, or $10.50 per decibel. Heating time for scald water was reduced 20%, from 40 to 32 minutes.

Poultry-processing plants utilizing scalders equipped with drilled-pipe steam-injection devices can obtain considerable reduction in steam-injection noise by substitution of suction-tee injection devices.

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